EFFECT OF PROLONGED OIL MASSAGE ON GROWTH VELOCITY IN LBW INFANTS: COMPARISON OF COCONUT OIL VS SUNFLOWER SEED OIL VS NO OIL – RANDOMIZED CONTROLLED TRIAL

Dissertation Submitted to

THE TAMIL NADU DR.M.G.R MEDICAL UNIVERSITY

In partial fulfillment of the regulations

For the award of the degree of

D.M. (NEONATOLOGY)

2010 – 2013

MADRAS MEDICAL COLLEGE

THE TAMIL NADU DR.M.G.R.MEDICAL UNIVERSITY

CHENNAI

CERTIFICATE

This is to certify that the dissertation entitled **"Effect of prolonged oil massage on growth velocity in LBW infants: Comparison of Coconut oil vs Sunflower seed oil vs No oil – Randomized controlled trial"** is a bonafide work done by **Dr.K. JAYASHEELA** during the period between March 2012 – February 2013 towards the partial fulfillment of requirement for the award of D.M. (NEONATOLOGY) degree examination to be held in August 2013 by The Tamil Nadu Dr.M.G.R. Medical University, Chennai.

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DECLARATION

I solemnly declare that the dissertation entitled **"Effect of prolonged oil massage on growth velocity in LBW infants: Comparison of Coconut oil vs Sunflower seed oil vs No oil – Randomized controlled trial"** is the original work done by me at the Institute of Obstetrics and Gynaecology and Hospital for women and Children, Egmore, Chennai during the D.M. course (2010-2013), under the guidance and supervision of Prof.Dr.J.Kumutha, Professor and H.O.D. of Neonatology. The dissertation is submitted to **THE TAMILNADU Dr.M.G.R. MEDICAL UNIVERSITY** towards the partial fulfilment of requirement for the award of **D.M. (Neonatology).**

Place: Chennai. **Dr.K. JAYASHEELA**

Date:

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EFFECT OF PROLONGED OIL MASSAGE ON GROWTH VELOCITY IN LBW INFANTS: COMPARISON OF COCONUT OIL VS SUNFLOWER SEED OIL VS NO OIL – RANDOMIZED CONTROLLED TRIAL Dissertation Submitted to THE TAMIL NADU DR.M.G.R MEDICAL UNIVERSITY In partial fulfillment of the regulations For the award of the degree of D.M. (NEONATOLOGY) 2010 – 2013 MADRAS MEDICAL COLLEGE THE TAMIL NADU DR.M.G.R.MEDICAL UNIVERSITY CHENNAI CERTIFICATE This is to certify that the dissertation entitled "Effect of prolonged oil massage on growth velocity in LBW infants: Comparison of Coconut oil vs Sunflower seed oil vs No oil – Randomized controlled trial" is a bonafide work done by Dr.K. JAYASHEELA during the period between March...

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

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CERTIFICATE OF APPROVAL

To
Dr. K. Jayasheela
PG in DM Neonatology
Madras Medical College, Chennai -3

Dear Dr. K. Jayasheela

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled " Effect of prolonged oil massage on growth velocity in LBW infants: comparison of Coconut oil vs Sunflower seed oil vs no oil – a Randomized controlled trail " No.18032012.

The following members of Ethics Committee were present in the meeting held on 22.03.2012 conducted at Madras Medical College, Chennai -3.

1.	Prof. S.K. Rajan. MD	-- Chairperson
2	Prof. Pregna B. Dolia MD Vice Principal, Madras Medical College, Chennai -3 (Director , Institute of Biochemistry, MMC, Ch-3)	-- Member Secretary
3.	Prof. B. Kalaiselvi. MD Prof of Pharmacology ,MMC, Ch-3	-- Member
4.	Prof. C. Rajendiran, MD Director , Inst. Of Internal Medicine, MMC, Ch-3	-- Member
5.	Thiru. S. Govindsamy. BA BL	-- Lawyer
6.	Tmt. Arnold Soulina MA MSW	-- Social Scientist

We approve the proposal to be conducted in its presented form.

Sd/ Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

CONTENTS

INTRODUCTION

INTRODUCTION

Massaging infants is an ancient art and traditional practice in several parts of India. Various types of oils have been used depending on regional variability. Evidence exists supporting the benefits of touch and massage therapy.[1] Massage has several positive effects in terms of weight gain, better sleep weight pattern and enhanced neuromotor development.[2,3,4,5] . Most consistent benefit associated with massage therapy is weight gain. Studies have shown improved skin barrier function, reduced rates of nosocomial infection, duration of hospital stay and mortality in hospitalized babies [21].There are no studies on extended home based massage therapy in babies. We wanted to study the effects of massage therapy which was extended for a duration of 3 months on anthropometric parameters ,readmissions and mortality. There is evidence supporting positive effects of massage therapy by mothers on babies. In our study mothers were trained to give massage therapy in hospital .This was continued as a home based therapy following discharge for a duration of 3 months.

Massage gives tactile kinaesthetic stimulation .Improved weight gain was demonstrated by studies using massage alone without oil[4]

and massage using different types of oil like Sunflower seed oil, Coconut oil, Mustard oil, Sesame oil and mineral oil. Topical application of vegetable oil results in transcutaneous absorption which influences fatty increase was higher in the oil group. This has been demonstrated in studies using saturated Fatty acid rich Coconut oil and essential Fatty acid rich Sunflower seed oil. Using Sunflower seed oil as emollient acid profile of babies.[16] Post massage triglycerides was significantly raised using Sunflower seed oil, Coconut oil and using No oil , but the quantum of therapy has resulted in 40 % reduction in mortality and 40 % reduction in sepsis in Bangladesh. Both these oils are widely available and cost effective strategies for better weight gain and survival of LBW babies. Which oil causes best weight gain is a gap in research. This study was designed with the objective of testing the hypothesis that massage with Coconut oil causes better weight gain than Sunflower seed oil and no oil in LBW babies.

Massaging using oil confers both tactile kinaesthetic stimulation and transcutaneous absorption of fat through thin skin resulting in better weight gain [15,16,17]. We wanted to compare the effects of massage therapy in AGA and SGA babies.

REVIEW OF LITERATURE

LITERATURE REVIEW

Neonatal intensive care unit with alarms and bright lights causes stress in babies. Neonatal massage reduces stress levels and improves the growth and development of preterm and low birth weight infants[1.] Positive effects include better weight gain, thermoregulation, less stress behaviour, improved sleep, neuromotor development and infant-parent bonding. Oil massage reduces transepidermal water loss and improves thermoregulation. It can contribute to improved nutrition and better somatic growth. Barrier function decreases nosocomial sepsis.

There are several studies showing weight gain with massage therapy in neonates. Scafidi, *et al.*(2) observed that infants who received massage had 21% greater weight gain (34 *vs* 28 g). Another study showed weight gain to be 47% greater with similar massage therapy. Weight gain of 21.9%; 4.24g/day was seen by Mathai, *et al.*(4)

Diego, *et al.*(6) attributed weight gain to increase in vagal activity which causes improved gastric motility leading to weight gain. Serum insulin and serum IGF-1 levels (7) were elevated in preterm massaged infants. Decreased level of energy expenditure has

been associated with increased weight gain(12) Sankaranarayanan et al compared coconut oil, mineral oil and placebo in 1.5-2 kg infants massaged 4 times a day for 1 month. Coconut oil massage showed a greater weight gain compared to mineral oil(13). Sesame oil has been compared to mustard and mineral oil (14).

Preterm skin can absorb oil being thin (15). Safflower oil and coconut oil massage for 5 days showed raised triglyceride levels (16). Linoleic acid was raised in massage using soybean oil (17). Massage with or without oil (18) did not affect triglyceride levels were in another study.

Stress is reduced in massaged babies (5) . Epinephrine and norepinephrine levels were high in massaged babies (10). Thermoregulation was better with massage therapy (11). 2-4 weeks duration of therapy was chosen in many studies (24). Mothers can be effectively trained in giving massage (25). Moderate pressure gives more weight gain than light pressure (26). Tactile kinaesthetic stimulation caused significant increase in heart rate within normal range. Respiratory rate, blood pressure were not affected in massaged infants (4).

Incidence of late onset sepsis was significantly less among 750-1500 g infants subjected to tactile- kinaesthetic stimulation (19,20).

Duration of hospital stay was less with massage therapy (2,3,12). Darmstadt et al showed 41% reduction in nosocomial infections in preterm infants less than 33 weeks who received topical emollient treatment with sunflower seed oil than controls. Increased natural killer cells (NK cells) were found in those who were massaged.

Most studies were done on stable preterm infants. Studies have shown that sick infants have better weight gain than stable infants (26). Allergic rash is the adverse effect using oil.

AIMS AND

OBJECTIVES

AIMS AND OBJECTIVES

RESEARCH QUESTION:

Does massage for 3 months with coconut oil in neonates weighing 750-2000 gms cause more weight gain compared to sunflower oil and no oil?

OUTCOME VARIABLE:

PRIMARY OUTCOME- To study the effect of massage with coconut oil vs sunflower oil vs control with no oil on weight gain in SGA and AGA neonates weighing 750 gms-2000 gms

SECONDARY OUTCOME- length gain, head circumference gain, incidence of sepsis after enrolment, duration of hospital stay and readmissions

JUSTIFICATION:

Several studies have proved the effect of massage therapy on weight gain. But still the research gap exists on which oil to recommend or whether massage therapy alone without oil can effect any change. This study is an attempt at bridging this gap.

MATERIALS AND METHODS

MATERIAL AND METHODS:

STUDY DESIGN:

Open Randomized Controlled trial

SETTING:

Intramural newborn unit in Institute of Obstetrics and Gynaecology

PERIOD OF STUDY:

March 2012 to February 2013

SAMPLE SIZE:

To detect a minimum difference of 2g/kg/day in weight between the groups a sample size of 288 subjects (96 per group) achieves 90% power at significance level of 0.05

STUDY POPULATION:

Intramural AGA and SGA babies weighing between 750 to 2000 grams fulfilling the inclusion criteria.

INCLUSION CRITERIA:

- AGA and SGA babies between 750-2000 gms who are hemodynamically stable and on breastfeeds, paladai feeds or NG feeds of 100 ml/kg/day by day21 of life
- Parental consent

EXCLUSION CRITERIA:

- Babies with skin infection
- Babies with congenital anomaly

RANDOMIZATION:

Randomization -	After stratification for AGA and SGA, using computer based randomization software, random numbers were generated.
Blocking -	Block randomization is done using random variable block sizes of 3 ,6 and 9
Randomization Group -	• Coconut Oil • Sunflower seed Oil • No oil(Control)
Allocation Concealment -	Randomization sequence is placed sequentially in opaque envelopes and sealed. Envelopes will be opened sequentially on enrolment of subjects

Mothers were be trained using demonstrations and audiovisual aids to give massage twice a day .Babies were enrolled after they reached I00 ml/kg NG or paladai feeds. They were advice to continue therapy for 3 months. Mothers were instructed to follow up at least once every 15 days till 90 days following discharge .Incidence of

sepsis, duration of hospital stay and readmissions in 3 months are other parameters studied.

Oil application and massage:

To reduce contamination 5ml sachets of the designated oil was given to the oil groups. Sachets were identical in colour and size with coding to avoid contamination between study groups. Liquid paraffin was used as lubricant for massaging in the NO oil group.

. Mother's were instructed to give massage twice a day under controlled conditions of temperature and feeding. Coded sachets were given for the oil group to avoid contamination between study groups120 sachets of the allocated oil was given to ensure continuity of therapy.

Mathai technique was used for massage. Massage was advised 1 hr following feeds. 2 phases of tactile stimulation was used. In pronposition 12 strokes of 5 sec each was given starting from head, neck, shoulder to buttocks followed by therapy in supine position comprising of 12 strokes of 5 sec each starting from face, cheeks, chest, abdomen, upper limb, lower limb, palms and soles. Lastly alternate flexion and extension movements were a given at ankle, knee, elbow and shoulder joints. Interruption for a few minutes while baby cries or passes urine and motion was advised.

During the massage, infants were massaged under a radiant warmer and subsequently in a warm room in the postnatal wards.

All term and preterm neonates above 1800 grams were breast fed along with EBM Paladai feeds from day1. Babies between 1500 - 1800 gram birth weights were given expressed milk starting at 80 ml/kg /day on day one or day 2. Massage therapy was initiated after attainment of 100ml/kg/day. From day 14,all study infants were given oral calcium, phosphorus and vitamin supplements. On discharge all mothers were advised to continue massage in a warm room.

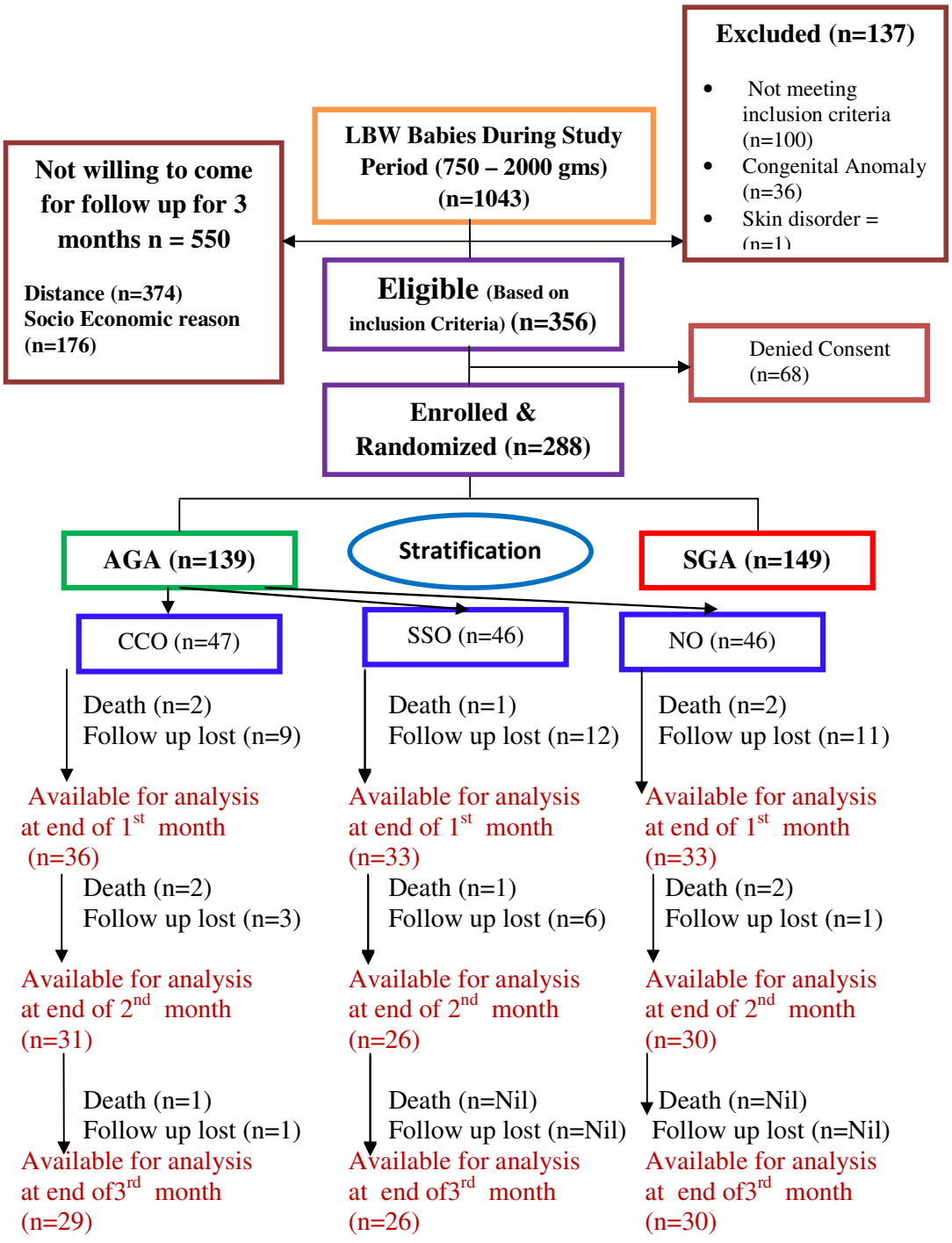
Weight of infants was taken without clothes on an electronic weighing scale with an accuracy of ± 5 grams. Head circumference was measured with a non-stretchable tape. Length was taken with infantometer. Babies were followed up daily during their stay in the hospital and then once every15 days till 3 months of age.

RESULTS AND ANALYSIS

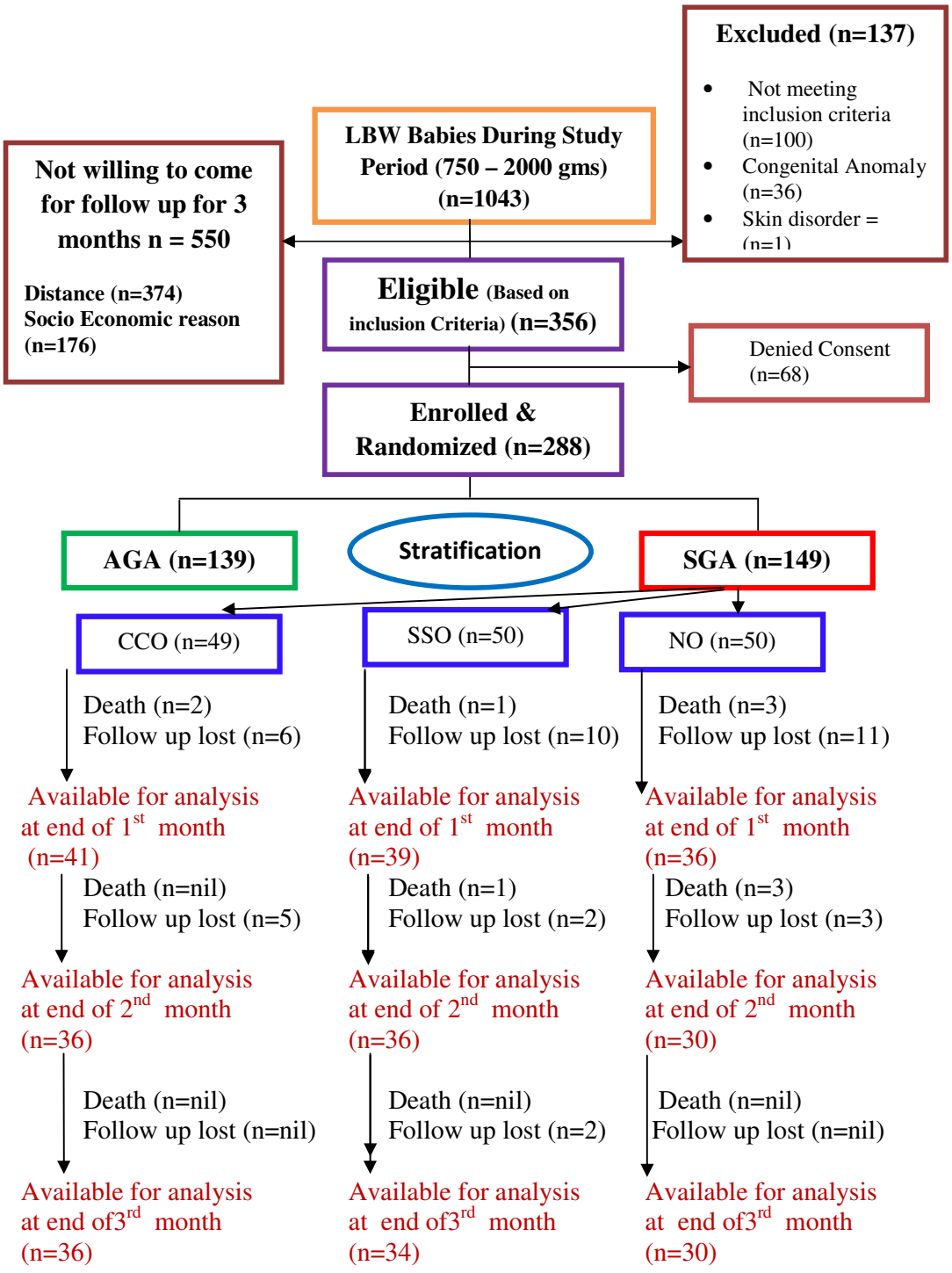
ANALYSIS

Characteristics of infants included in the study were tabulated as averages (means) with standard deviation (SD). The groups were compared on each parameter using 't' test and Chi square test. ANOVA was used for comparing between the 3 groups. The analysis was done using the SPSS version 16.0 for windows. A *'P'* value of <0.05 was considered as statistically significant.

CONSORT FLOW DIGRAM



CONSORT FLOW DIGRAM



RESULTS

A total of 288 babies weighing between 750 gms to 2000 gms(139 AGA and 149 SGA) were enrolled. In AGA group, there were 47 babies in the coconut oil, 46 in the sunflower seed oil and 46 babies in the no oil group. In SGA group, there were 49 babies in the coconut oil, 50 in the sunflower seed oil and 50 babies in the no oil group.

In the AGA group, 29 (61.7%) babies in the coconut oil group, 26 (56.52%) in the sunflower seed oil group and 30 (65.2%) in the No oil group completed the follow up for 3 months. In the SGA group, 36 (73.46 %) babies in the coconut oil group, 34(68%) in the sunflower seed oil group and 30 (60%) in the No oil group completed follow up for 3 months .Totally 85(61.15%) babies in the AGA group and100 (67.11%) babies in the SGA group and overall 185(64.23%) babies(AGA and SGA) completed follow up for a duration of 3 months

Table 1 shows the baseline maternal characteristics enrolled in the Study groups. There was no statistically significant difference between maternal variables of gravida, parity, diabetes, PIH, hypothyroidism, infertility treatment, antenatal steroids and doppler abnormalities

Table-1 Baseline Maternal Characteristics

VARIABLE	**n**	**CCO N=96 NO.(%)**	**SSO N=96 NO.(%)**	**NO MASG N=96 NO.(%)**	P-value
Vaginal Birth	197	63(32)	68(35)	66(33)	0.915
LSCS	91	33(36)	28(31)	30(33)	
Gravida-Primi	271	87(32)	93(34)	91(34)	0.261
Multi	17	9(53)	3(18)	5(29)	
Birth Asphyxia	24	7(29)	7(29)	10(42)	0.664
Diabetes	7	2(29)	4(57)	1(14)	0.359
PIH	61	19(31)	25(41)	17(28)	0.339
Hypothyr	7	2(29)	3(43)	2(29)	0.864
Inf.Dis	6	3(50)	2(33)	1(7)	0.600
Infertility	12	7(58)	2(17)	3(25)	0.161
MSAF	9	4(44)	3(33)	2(22)	0.709
PROM	87	29(33)	27(31)	31(36)	0.821
Placenta	17	5(29)	5(29)	7(41)	0.920
Ant Steroid	125	44(35)	38(30)	43(34)	0.645
Doppler	23	5(22)	6(26)	12(52)	0.131

CCO – coconut oil
SSO – sunflower oil
No – no oil

Table 2 Baseline Neonatal Characteristics

VARIABLE	n	CCO n=96 NO.(%)	SSO n=96 NO.(%)	NO n=96 NO.(%)	P-value
Sex -Male	164	61(37)	52(32)	51(31)	0.276
Female	124	35(28)	44(36)	45(36)	
CPAP	42	11(26)	11(26)	20(42)	0.105
Vent	13	6(42)	3(23)	4(31)	0.569
TTN	47	12(26)	19(40)	16(34)	0.390
HMD	13	3(23)	4(31)	6(46)	0.569
Cul.+ sepsis	17	6(35)	4(24)	7(41)	0.646
Phototherapy	68	27(40)	19(28)	22(32)	0.389
Apnea	13	3(23)	3(23)	7(54)	0.276
Hypoglycemia	8	4(50)	1(13)	3(37)	0.407
Feed Intolerance	44	14(32)	15(34)	15(34)	0.974

CCO – coconut oil
SSO – sunflower oil
No – no oil

Table 2 shows the baseline pre enrollment variables of CPAP, Ventilation, TTN, HMD, sepsis, phototherapy, apnea, hypoglycemia and feed intolerance in babies. There was no statistical significant different between the variables.

able-3 Baseline Characteristics In Study Group

VARIABLES	CCO (n=96)	SSO (n=96)	NO (n=96)	P-value
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Birth Weight				
AGA	1411 ± 235.59	1455 ± 228.13	1431 ± 267.75	0.406
SGA	1517 ± 282.45	1520 ± 313.55	1427 ± 312.48	0.226
Gestational Age				
AGA	31.77 ± 1.462	31.98 ± 1.584	31.52 ± 1.823	0.628
SGA	35.29 ± 1.978	35.14 ± 2.06	34.76 ± 2.43	0.457
Length				
AGA	48.51 ± 48.83	49.12 ± 50.93	41.02 ± 2.45	0.616
SGA	42.55 ± 2.67	41.93 ± 3.13	41.42 ± 3.41	0.196
Head Circumference				
AGA	29.15 ± 2.83	28.85 ± 2.33	29.67 ± 1.60	0.593
SGA	29.47 ± .48	29.80 ± 2.30	29.34 ± 2.39	0.527
Day on Enrolment				
AGA	9.4 ± 4.836	8.33 ± 5.203	9.26 ± 5.744	0.569
SGA	9.19 ± 5.242	8.66 ± 4.984	10.14 ± 4.924	0.335
Weight on enrolment				
AGA	1414 ± 236	1455 ± 228.13	1430 ± 267.74	0.724
SGA	1511 ± 282.34	1540 ± 330.55	1427 ± 312.48	0.224

CCO – coconut oil

SSO – sunflower oil

No – no oil

There was no significant difference in baseline characteristics in both AGA and SGA**.**

Table 4 Growth Characteristics in Study Group during First Month

VARIABLES	CCO (n=77)	SSO (n=72)	NO (n=69)	P-value
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Mean Weight Gain / day	17.8 ± 12	19.3 ± 10.54	16.84 ± 9.04	0.38
Length Gain / day	0.73 ± 0.41	0.84 ± 0.434	0.71 ± 0.42	0.12
Head Circumference Gain / day	0.66 ± 0.30	0.74 ± 0.43	0.65 ± 0.28	0.18

CCO – coconut oil
SSO – sunflower oil
No – no oil

During the First month Mean weight gain was 17.8 gms vs 19.3 gms vs 16.8 gms in Massage with coconut oil, sunflower seed oil and No oil groups. Length gain and Head Circumference gain was more in sunflower seed oil though not statistically significant.

Table 5 Growth Characteristics in Study Group during Second Month

VARIABLES	CCO (n=67)	SSO (n=62)	NO (n=60)	P-value
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Mean Weight Gain / day	28.06 ± 10.74	28.30 ± 10.75	26.80 ± 9.77	0.70
Length Gain / day	0.92 ± 0.40	0.90 ± 0.82	0.91 ± 0.33	0.96
Head Circumference Gain / day	0.52 ± 0.25	0.48 ± 0.21	0.55 ± 0.22	0.26

CCO – coconut oil
SSO – sunflower oil
No – no oil

During the Second month mean weight gain was 28.06 gms vs 28.3 gms vs 26.8 gms in massage with coconut oil, sunflower seed oil and No oil groups. There was no significant difference in increase in weight, length gain and Head circumference gain in all groups.

Table 6 Growth Characteristics in Study Group during Third Month

VARIABLES	CCO (n=65)	SSO (n=60)	NO (n=60)	P-value
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Mean Weight Gain / day	25.23 ± 9.76	26.61 ± 8.98	26.53 ± 8.68	0.65
Length Gain / day	0.78 ± 0.32	0.77 ± 0.33	0.91 ± 0.32	0.04
Head Circumference Gain / day	0.42 ±0.18	0.42 ± 0.21	0.46 ± 0.22	0.45

CCO – coconut oil
SSO – sunflower oil
No – no oil

During the Third month Mean weight gain was 25.2 gms vs 26.6 gms vs 26.5 gms in massage with coconut oil, sunflower seed oil and No oil groups. Length gain was statistically significant in no oil group.

Table 7 Growth Characteristics in Study Group for(0-3) months

VARIABLES	CCO	SSO	NO	P-value
	(n=65)	(n=60)	(n=60)	
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Mean Weight Gain / day	23.48 ± 7.69	25.02 ± 7.07	23.33 ± 6.4	0.35
Length Gain / day	1.11 ± 2.39	0.83 ± 0.19	0.83 ± 0.21	0.45
Head Circumference Gain / day	0.60 ± 0.53	0.54 ± 0.16	0.64 ± 0.69	0.53

CCO – coconut oil
SSO – sunflower oil
No – no oil

During the therapy period of 0 - 3 months mean weight gain was 23.4 gms vs 25 gms vs 23.3 gms in massage with coconut oil, sunflower seed oil and No oil groups. Weight gain was more in sunflower seed oil group though statistically not significant. There was no significant difference in weight, length and Head circumference gain in all groups.

Table- 8 Growth Characteristics in AGA during First month

VARIABLES	CCO	SSO	NO	P-value
	(n=36)	(n=33)	(n=33)	
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Mean Weight Gain / day	14.83 ± 12.73	14.40 ± 8.83	15.48 ± 9.79	0.97
Length Gain / day	0.68 ± 0.44	0.76 ± 0.41	0.678 ± 0.38	0.63
Head Circumference Gain / day	0.57 ± 0.25	0.69 ± 0.21	0.67 ± 0.31	0.095

CCO – coconut oil
SSO – sunflower oil
No – no oil

During the First month mean weight gain was 14.8 gms vs 14.4 gms vs 15.4 gms in massage with coconut oil, sunflower seed oil and No oil groups. There was no significant difference in weight, length and Head circumference gain in all groups.

Table – 9 Growth Characteristics in AGA during Second month

VARIABLES	CCO	SSO	NO	P-value
	(n=31)	(n=26)`	(n=30)	
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Weight Gain / day	24.97 ± 10.96	27.83 ± 8.38	27.72 ± 10.90	0.473
Length Gain / day	0.78 ± 0.42	0.85± 0.26	0.91 ± 0.33	0.394
Head Circumference Gain / day	0.59 ± 0.25	0.54 ± 0.20	0.56 ± 0.25	0.658

CCO – coconut oil
SSO – sunflower oil
No – no oil

During the Second month mean weight gain was 24.9 gms vs 27.8 gms vs 27.7 gms in massage with coconut oil, sunflower seed oil and No oil groups. There was no significant difference in weight, length and Head circumference gain in all groups.

Table – 10 Growth Characteristics in AGA during Third month

VARIABLES	CCO	SSO	NO	P-value
	(n=29)	(n=26)`	(n=30)	
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Weight Gain / day	25.12 ± 10.28	29.49 ± 9.26	26.27 ± 9.92	0.258
Length Gain / day	0.775 ± 0.331	0.845 ± 0.374	0.90 ± 0.323	0.390
Head Circumference Gain / day	0.45 ± 0.20	0.46 ± 0.21	0.51 ± 0.197	0.552

CCO – coconut oil
SSO – sunflower oil
No – no oil

During the Third month mean weight gain was 25.12 gms vs 29.4 gms vs 26.2 gms in massage with coconut oil, sunflower seed oil and No oil groups. Mean weight gain was more in the sunflower seed oil groups though not statistically significant.

Table – 11 Growth Characteristics in AGA for 0-3 months

VARIABLES	CCO	SSO	NO	P-value
	(n=29)	(n=26)	(n=30)	
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Weight Gain / day	21.00 ± 8.27	24.45 ± 5.92	23.48 ± 7.56	0.196
Length Gain / day	0.775 ± 0.331	0.845 ± 0.374	0.90 ± 0.323	0.390
Head Circumference Gain / day	0.55 ± 0.15	0.59 ± 0.17	0.58 ± 0.0898	0.667

CCO – coconut oil
SSO – sunflower oil
No – no oil

During the therapy period of 0 - 3 months mean weight gain was 21 gms vs 24.4 gms vs 23.4 gms in massage with coconut oil, sunflower seed oil and No oil groups. Mean weight gain was more in sunflower seed oil group though statistically not significant. There was no significant difference in weight, length and Head circumference gain in all groups.

Table- 12 Growth Characteristics in SGA during First Month

VARIABLES	CCO	SSO	NO	P-value
	(n=41)	(n=39)	(n=36)	
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Mean Weight Gain / day	20.55 ± 10.74	23.46 ± 10.16	18.08 ± 8.28	0.064
Length Gain / day	0.787 ± 081	0.92 ± 0.46	0.744 ± 0.46	0.172
Head Circumference Gain / day	0.747 ± 0.32	0.790± 0.553	0.62 ± 0.27	0.218

CCO – coconut oil
SSO – sunflower oil
No – no oil

During the First month mean weight gain was 20.5 gms vs 23.4 gms vs 18 gms in massage with coconut oil, sunflower seed oil and No oil groups. There was no significant difference in weight, length and Head circumference gain in all groups.

Table- 13 Growth Characteristics in SGA during Second month

VARIABLES	CCO	SSO	NO	P-value
	(n=36)	(n=36)	(n=30)	
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Mean Weight Gain / day	31.15 ± 9.73	28.70 ± 12.53	25.88 ± 8.46	0.143
Length Gain / day	1.05 ± 0.35	0.94 ± 0.32	0.929 ± 0.33	0.283
Head Circumference Gain / day	0.45 ± 0.25	0.43 ± 0.219	0.542 ± 0.20	0.165

During the Second month mean weight gain was 31.1 gms vs 28.7 gms vs 25.8 gms in massage with coconut oil, sunflower seed oil and No oil groups. Mean weight gain and length gain was more in coconut oil group though statistically not significant. There was no significant difference in weight, length and Head circumference gain in all groups.

Table- 14 Growth Characteristics In SGA during Third Month

VARIABLES	CCO	SSO	NO	P-value
	(n=36)	(n=34)	(n=30)	
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Mean Weight Gain / day	25.34 ± 9.45	24.37± 9.79	26.79 ± 7.41	0.104
Length Gain / day	0.79 ± 0.32	0.730 ± 0.305	0.936 ± 0.33	0.042
Head Circumference Gain / day	0.39 ± 0.165	0.40 ± 0.219	0.42 ± 0.24	0.848

CCO – coconut oil
SSO – sunflower oil
No – no oil

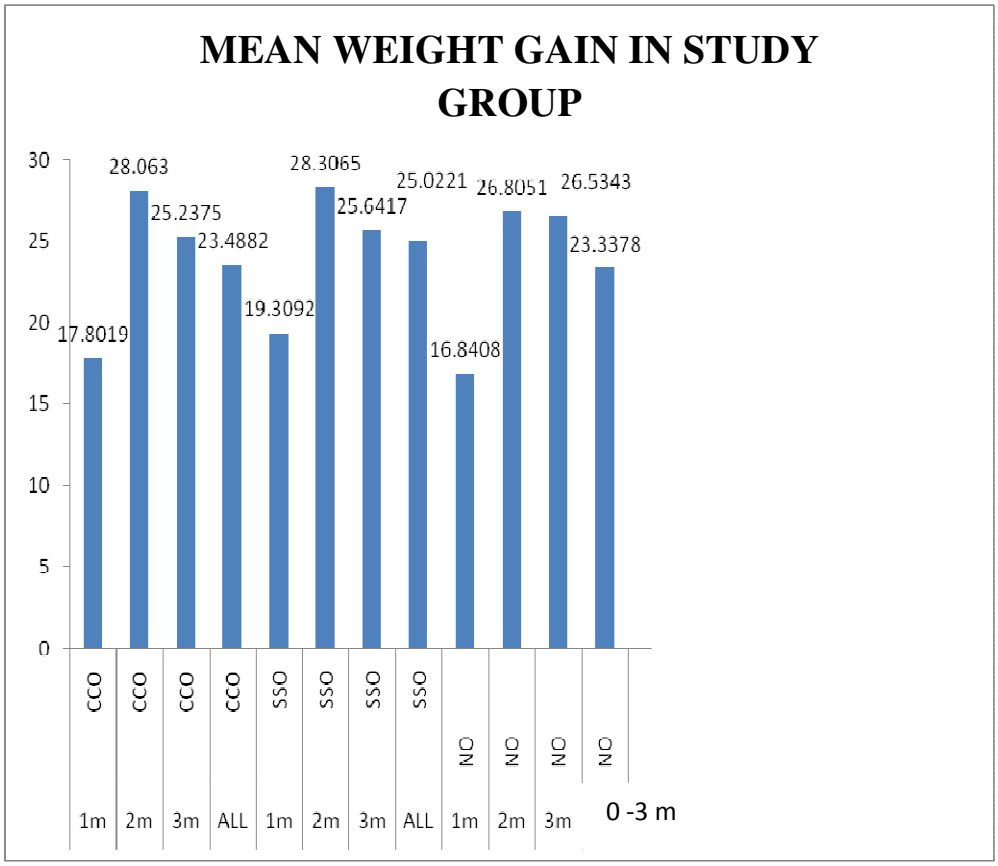
During the Third month mean weight gain was 25.3 gms vs 24.3 gms vs 26.7 gms in massage with coconut oil, sunflower seed oil and No oil groups. Mean length gain was statistically significant no oil group. There was no significant difference in weight and Head circumference gain in all groups.

Table- 15 Overall Growth Characteristics In SGA for 0-3 months

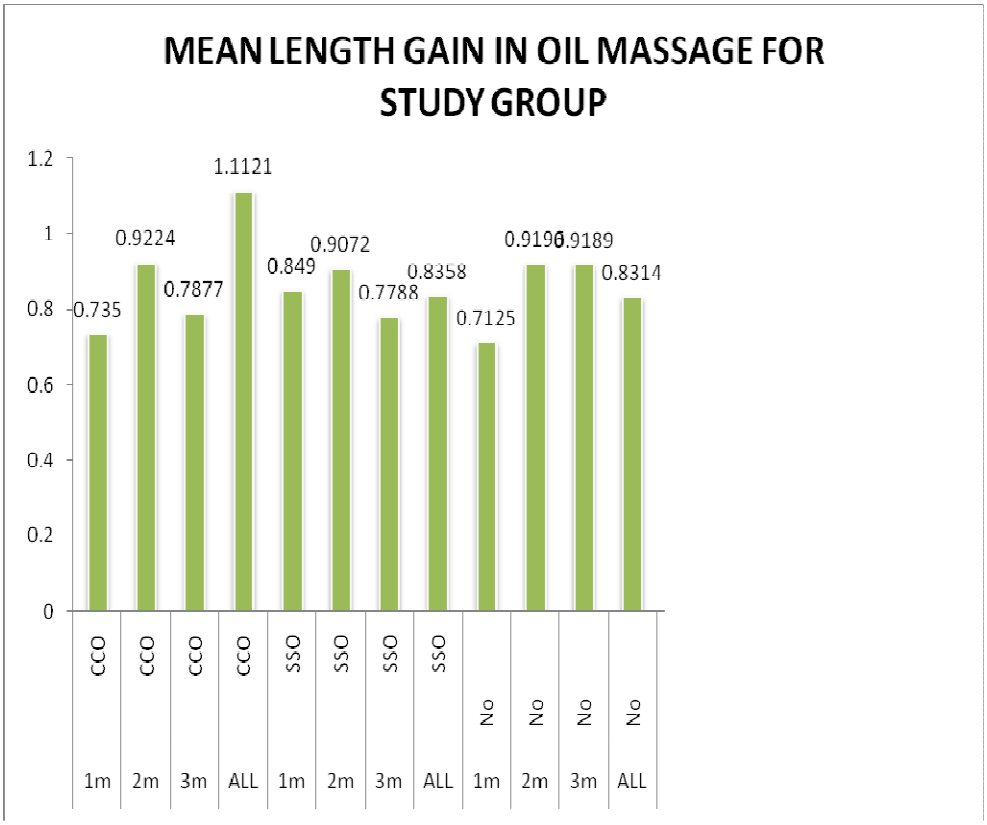
VARIABLES	CCO	SSO	NO	P-value
	(n=36)	(n=34)	(n=30)	
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Mean Weight Gain / day	25.62 ± 6.55	25.45 ± 7.91	23.19 ± 5.19	0.281
Length Gain / day	1.401 ± 3.24	0.846 ± 0.194	0.82 ± 0.24	0.389
Head Circumference Gain / day	0.65 ± 0.72	0.50 ± 0.154	0.71 ± 0.98	0.478

CCO – coconut oil
SSO – sunflower oil
No – no oil

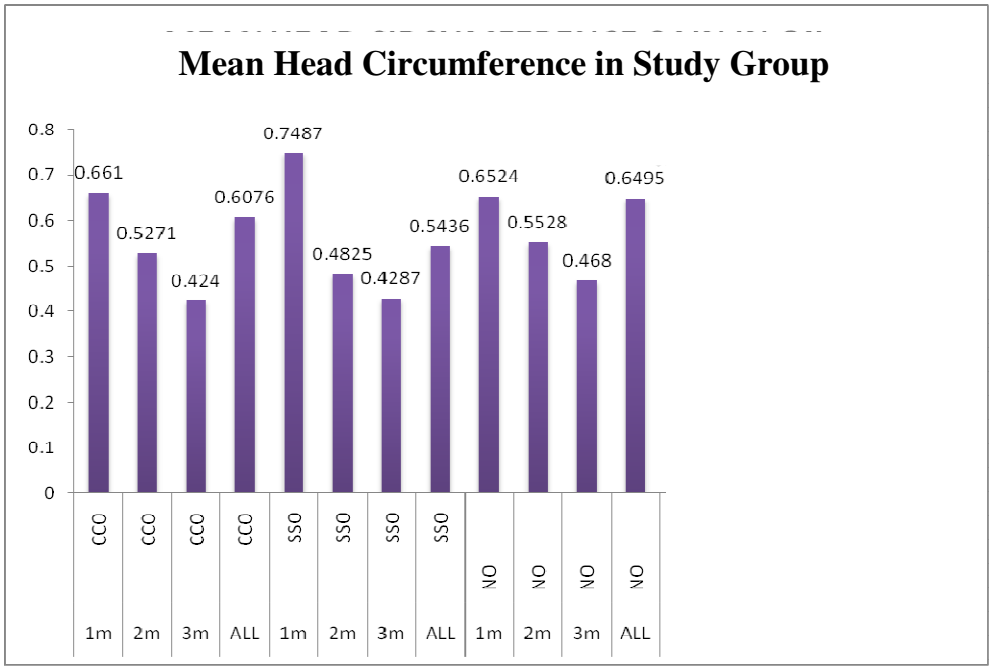
During the therapy period of 0 - 3 months mean weight gain was 25.6 gms vs 25.4 gms vs 23.1 gms in massage with coconut oil, sunflower seed oil and No oil groups. Weight was more in oil groups though not statistically significant. There was no significant difference in weight, length and Head circumference gain in all groups.



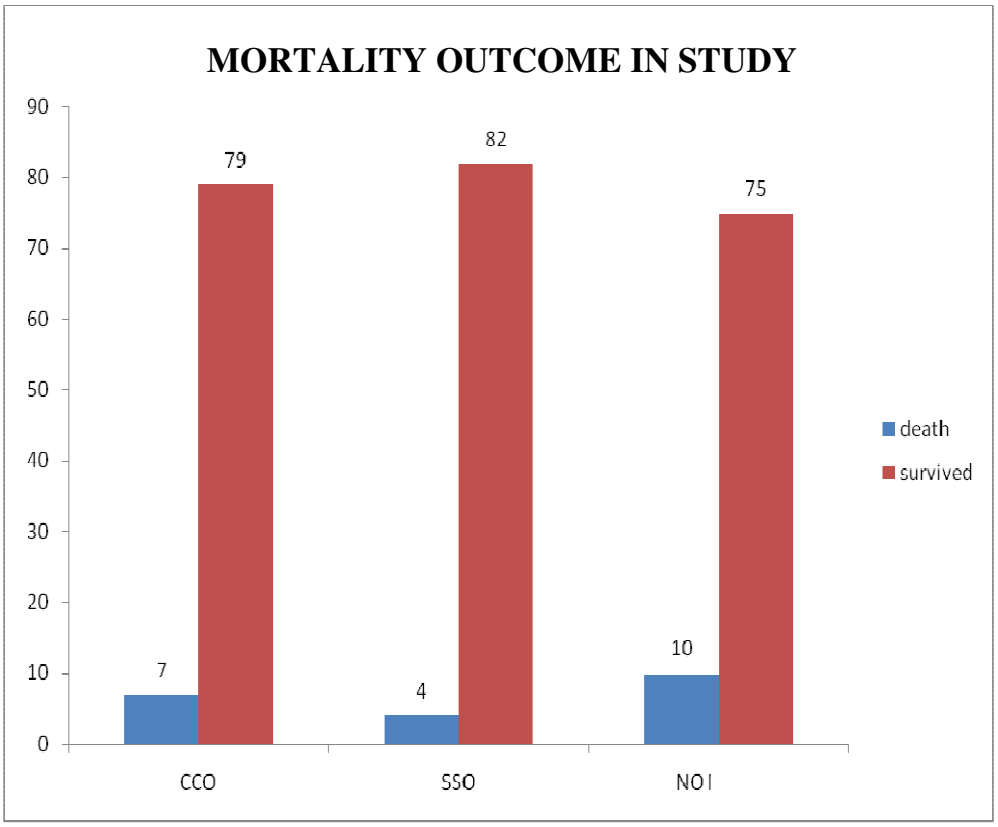
CCO – coconut oil
SSO – sunflower oil
No – no oil
ALL - 0 – 3 months



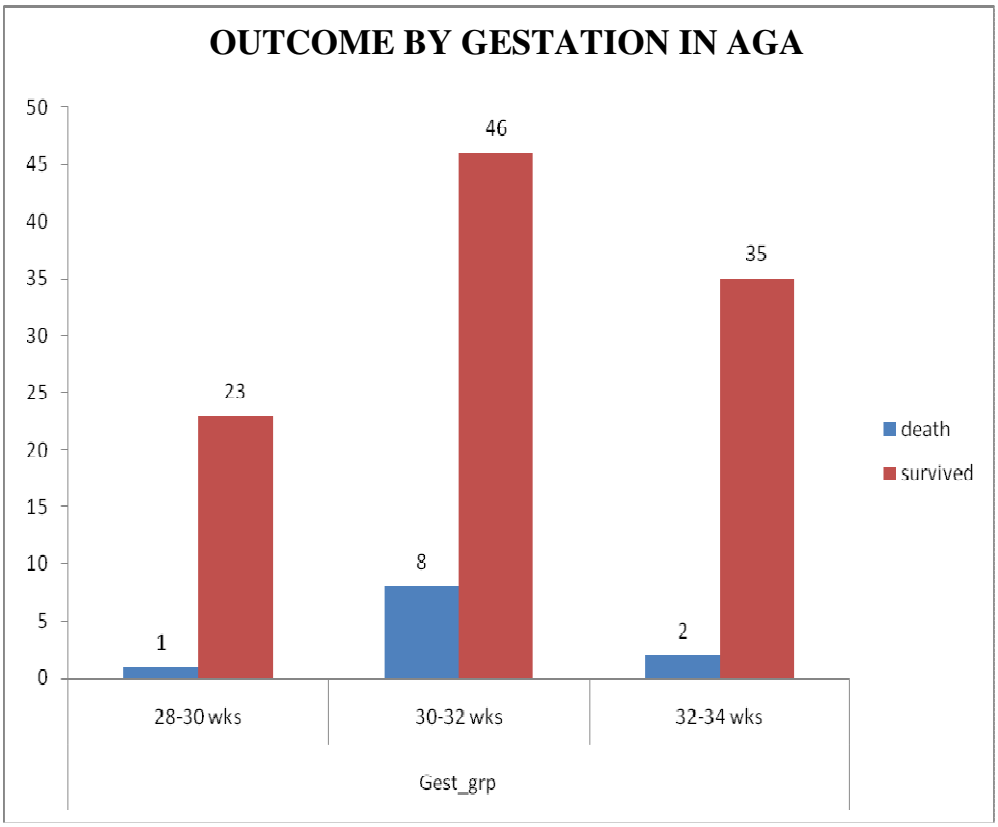
CCO – coconut oil
SSO – sunflower oil
No – no oil
ALL - 0 – 3 months



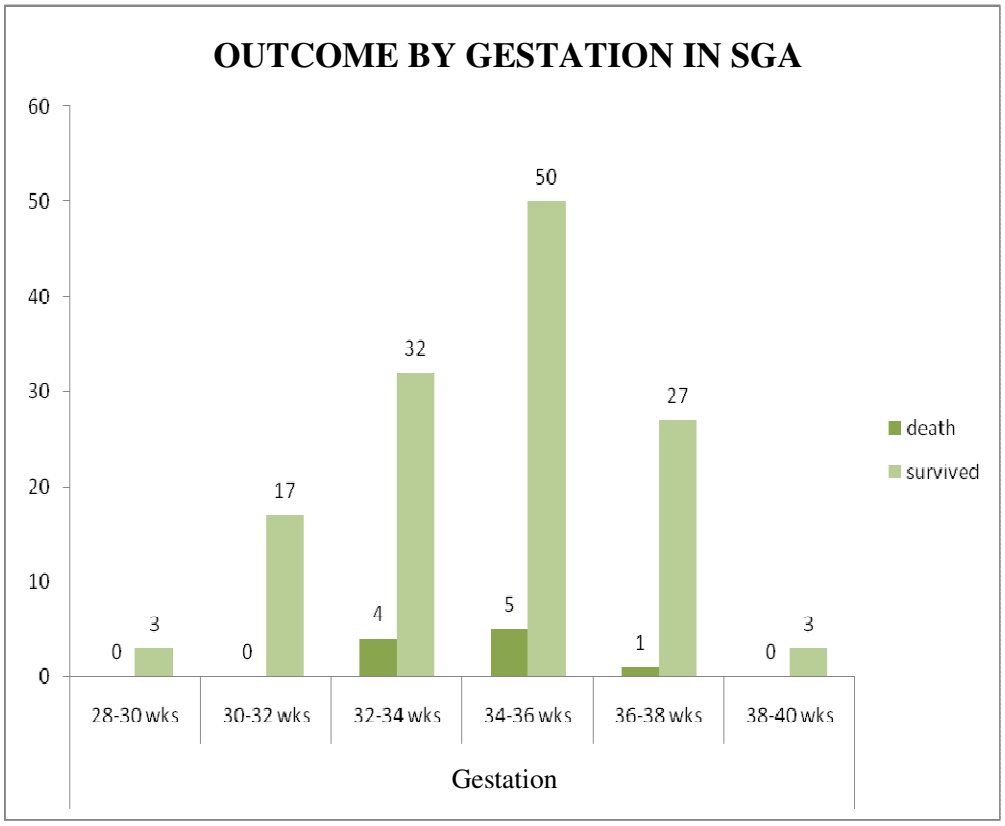
CCO – coconut oil
SSO – sunflower oil
No – no oil
ALL - 0 – 3 months



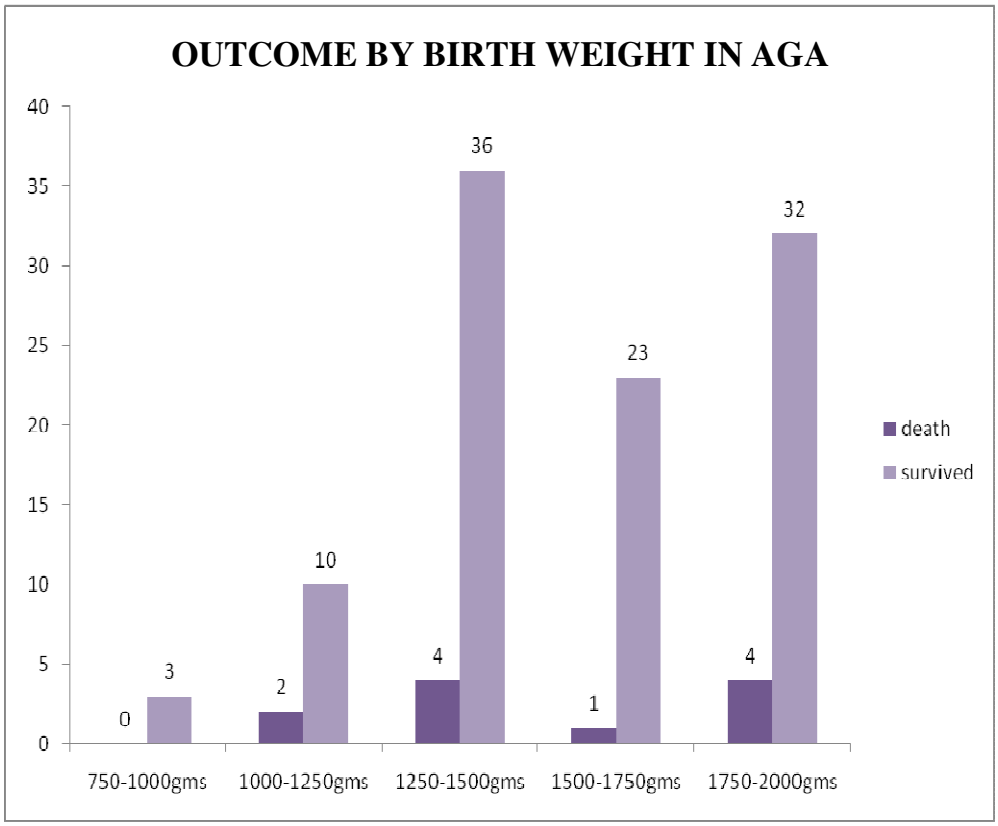
Out of 21 babies mortality was more in no oil group and least in the sunflower seed oil group.



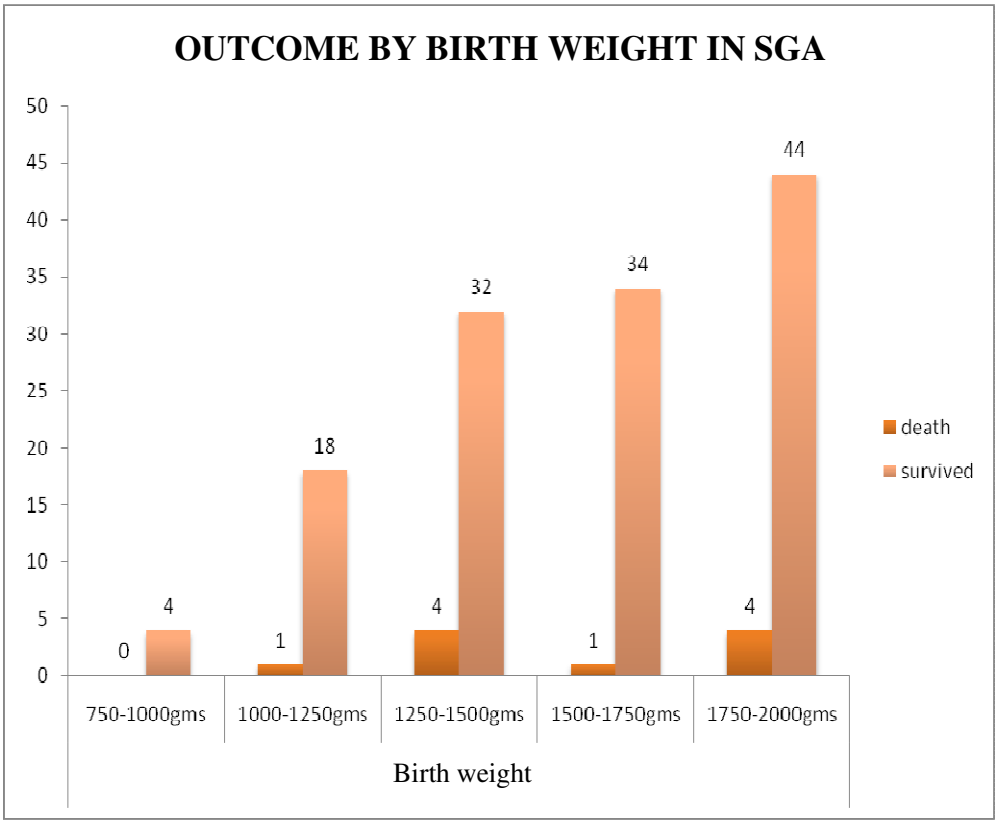
Out of 23 babies in AGA between 28 – 30 weeks only one baby expired. Maximum mortality was between 30 – 32 weeks.



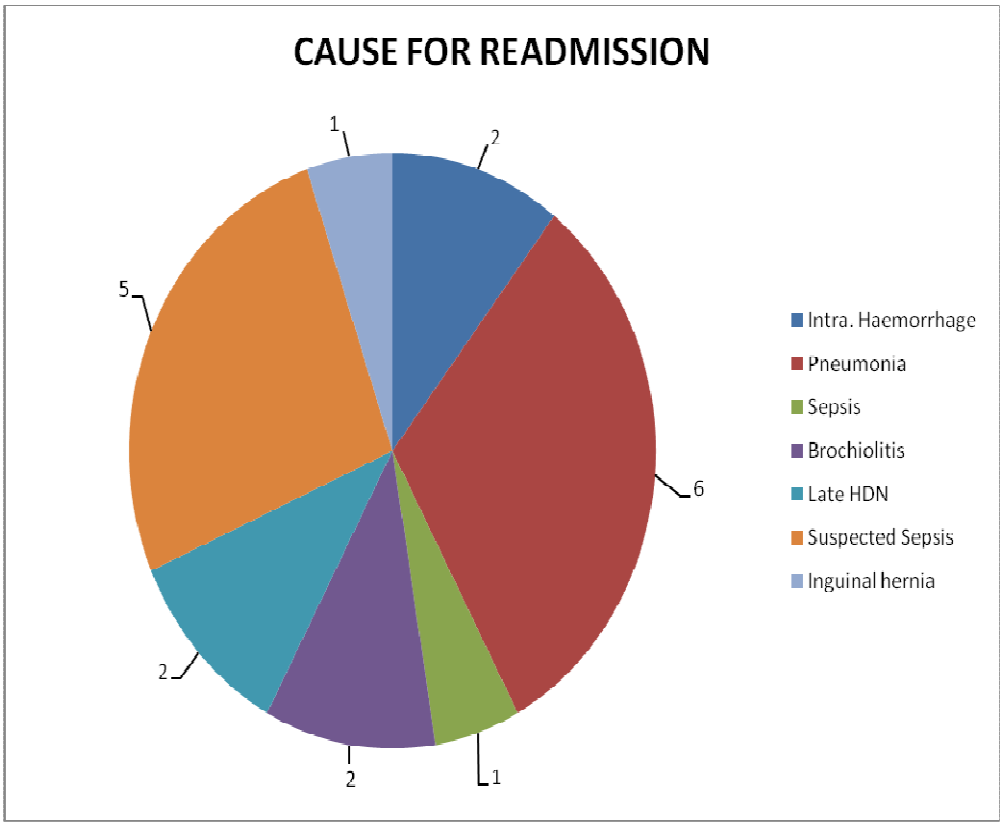
There was no mortality in the 28 – 30 weeks and 30 -32 weeks SGA babies. Maximum mortality occured between 34 – 36 weeks.



In massaged AGA babies there was no mortality in the 750 – 1000 gms. Totally 11 babies out of 139 babies expired (7.9%).



In massaged SGA babies there was no mortality in the 750 – 1000 gms. Totally 10 babies out of 149 babies expired (6.7%).



Most of the readmissions were due to pneumonia followed by suspected sepsis followed by bronchiolitis and HDN.

DISCUSSION

DISCUSSION

Several studies have proved benefits of tactile kinesthetic stimulation in preterm infants with regards to weight gain(4,11 Both saturated fatty acid rich coconut oil and EFA rich sunflower seed oil are vegetable oils that are widely available and within reach of mothers. We wanted to test the effect of the massage using Coconut oil, Sunflower seed oil and No oil on weight, length, head circumference in AGA and SGA babies weighing between 750 gms to2000 gms. Duration of hospital stay, mortality, readmissions, incidence of sepsis following enrolment were also studied.

The skin of a preterm baby allows significant absorption of fat, as it is thinner and more vascular (15,16,17). We in our study also wanted to study whether the effect of massage in SGA babies would be different as compared to AGA. Fernandez, *et al.*(17) reported a significantly higher serum triglyceride levels in preterm neonates weighing 1500-2250 g after application of corn oil every four hours for three days suggesting the likelihood of fatty acid absorption through the skin of preterm neonates. Soriano, *et al* (18) reported a significant increase in anthropometric parameters at one month of age in 30 consecutive preterm infants who were treated cutaneously with

soybean oil compared to a control group, which received no cutaneous treatment. An increase in linoleic acid level in their blood was also observed. In the study by Sankaranarayanan et al, In preterm neonates there was a statistically significant increase in weight using coconut oil versus mineral oil and no oil. In term neonates there was there was a no statistically significant increase in weight using coconut oil versus mineral oil but between coconut oil and no oil there was a significant increase in weight gain. There was no statistically significant increase in length and head circumference parameters between the 3 groups in both preterm and term groups. In contrast, Agarwal, *et al*.(6) observed that full term infants at 6 weeks massaged with sesame oil showed a significant increase in length, midarm and midleg circumferences compared to infants receiving herbal oil, mustard oil, or mineral oil for massage daily for 4 weeks. Mathai, *et al.*(4) have shown better weight gain after tactile kinesthetic stimulation using powder or oil as lubricant against a control group with no masage.Arora et al showed a significant increase in weight gain using massage with sunflower seed oil versus only massage and no massage. We adopted the massage technique used by Mathai et al in their study. Moderate pressure was used. Mothers were trained to give massage therapy.

There are no comparative studies to test weight,length and head circumference gain between coconut oil and sunflowerseedoil and no comparative studies betweenAGA and SGA infants and no comparative studies on weight,length and headcircumference gain if extended for prolonged period of 3 months.In our study, even if we take only the first month data on weight,lenghth and headcircumference there was no statistically significant increase in weight,length and headcircumference between coconut oil, sunflower seed oil and no oil groups. In the AGA group the mean weight gain in the 2^{nd},3^{rd} month and the overall weight gain for 3 months was more in the sunflower seed oil group though not statistically significant. The mean difference in weight gain, length gain, head circumference gain between coconut oil and sunflower seed oil was not significant. There was no significant difference between CCO versus NO oil and SSO versus NO oil with regards to weight length and head circumference.

In SGA babies, The weight of babies in the three groups was comparable at baseline. However, at 1 month the mean weight gain in the SSO subgroup was higher compared to CCO and NO(23.45 VS 20.55 VS 18.08 with p value of 0.06) though not significant. The

length gain in the 3rd month in the No oil group was significantly more with p value of 0.042.There was no significant difference between CCO versus NO oil and SSO versus NO oil with regards to weight , length and head circumference.

It was proved in a randomised control trial in Bangladesh that skin application with sunflower seed oil protects against nosocomial infections in preterm VLBW babies. Comparison was made between Aquaphor (petrolatum, mineral oil, minearal wax and lanolin alcohol) and sunflower seed oil.It was observed that in infants born before 33 weeks gestation who received topical emollient treatment with sunflower seed oil were 41% less likely to develop nosocomial infections than controls. In our study we observed that mortality was lower in sunflower seed oil group compared with the coconut oil group and no oil group.

Mortality was higher in no oil group though not statistically significant. In AGA babies totally 11 babies out of 139 babies expired (7.9). Between 28 – 30 weeks only one baby expired. Maximum mortality was between 30 – 32 weeks. In massaged AGA babies there was no mortality in the 750 – 1000 gms.

There was no mortality in the 28 – 30 weeks and 30 -32 weeks in SGA babies. Maximum mortality occured between 34 – 36 weeks. In massaged SGA babies there was no mortality in the 750 – 1000 gms. Totally 10 babies out of 149 babies expired (6.7%). In our study we found that massage therapy was improving survival of VLBW babies

There are no studies comparing readmission rates between different oil groups. In our study readmissions were same in both coconut oil and sunflower seed oil groups. Readmissions were higher in no oil group though not statistically significant.

Massage therapy acts as a natural care-giving stimulation causing increased weight gain and shorter hospital stay. Studies have shown that the mean duration of hospital stay was less in the massage versus no massage group. The mean duration of hospital stay was not significant in all our three groups which had massage. The duration of hospital stay was lowest in the coconut oil group ie,14 days as against 16 days in both Sunflower seed oil group and No oil group. Allergic rash was seen in the coconut oil group in 2 babies which subsided in a day. Hypothermia was found in 2 babies when the mother massaged the baby around 7 am in the morning.

LIMITATIONS

The main limitation in our study was not attaining the sample size due to overall follow-up of 64.23%.There is a possibility that a larger sample size could have proved statistical significance between our groups of coconut oil, sunflower seed oil and no oil. Our hospital is a referral hospital which caters to high risk mothers all over Tamilnadu. Though consent was given by the 288 enrolled babies to follow-up for 3 months, due to socioeconomic reasons and the difficulty in travelling to our hospital from other parts of Tamil nadu ,need for accompanying persons like husband, mother or father who had to work for daily income was a problem particularly in twins and triplets for the mothers of babies in our study.

IMPLICATIONS

The implications would be to conduct the study at a multicentric Level for a larger sample size using social workers who can make home visits and take weight using well calibrated electronic weighing scales .

CONCLUSION

CONCLUSION

- There was no significant difference in weight gain between Massage therapy using oil and Massage therapy using no oil.
- Tactile kinaesthetic stimulation seems to play the key role in weight gain in LBW babies than the oil used.
- Between sunflower seed oil and coconut oil there was no significant difference in weight gain between the groups.
- Tactile kinaesthetic stimulation in Massage therapy has the potential of causing weight gain in LBW babies.
- Extended Massage therapy is a home based cost effective strategy which can help in survival of LBW babies.

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WORKSHEET FOR AGA/SGA

NAME :

DATE OF BIRTH : TIME :

IP NO :

DISC NO :

SEX :

MOTHER IP NO :

DATE OF ADMISSION :

DATE OF DISCHARGE :

MODE OF DELIVERY : NORMAL/LSCS(ELECTIVE/EMERGENCY) / FORCEPS / VACUUM

BIRTH WEIGHT : grams

GESTATIONALAGE : weeks

APGAR : 1 mt: 5 mt:

MATERNAL DETAILS : Gravida : Para:

Ht: Wt: Hb:

LMP : EDD:

Blood group:

HIV/HbsAg/VDRL +/-

Sibling history:

Diabetes: Yes/No If Yes Meal plan/Insulin

PIH/PET :Yes/No

Eclampsia:Yes/No

Oligohydramnios: Yes/No

Polyhydramnios: : Yes/No

Hypothyroidism/Hyperthyroidism: Yes/No

Drug History:

Any infectious disease: Yes/No

Infertility treatment: Yes/No

Other illness:

CTG:Reactive/Nonreactive

Liquor:Clear/MeconiumStain/Foul smell

PROM: : Yes/No If Yes Hrs:

No of PV examination during labour:

Duration of labour:<24 hrs/>24 hrs

Placenta:

Antenatal USG/Doppler:

Antenatal steroidgiven: Yes/No No of doses:

DURATION OF HOSPITAL STAY:

READMISSIONS :

SEPSIS :

COURSE OF HOSPITAL STAY :

Day	Weight	Length	HC
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
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26			
27			
28			
29			
30			
45			
60			
75			
90			

ஆராய்ச்சி ஒப்புதல் கடிதம்

ஆராய்ச்சி தலைப்பு - மூன்று மாதங்கள் எடை குறைவுள்ள பச்சிளம் குழந்தைகளுக்கு தேங்காய் எண்ணெய் / அல்லது சூரியகாந்தி எண்ணெயினால் மசாஜ் அல்லது எண்ணெய் இல்லாமல் மசாஜ் செய்வதின் விளைவுகள்

இந்த ஆராய்ச்சியின் விவரங்களும், அதன் நோக்கங்களும் முழுமையாகவும் தெளிவாகவும் எனக்கு விளக்கப்பட்டது.

எனக்கு விளக்கப்பட்ட விஷயங்களை புரிந்து கொண்டு நான் எனது சம்மத்தை தெரிவிக்கின்றேன்.

1000g - 2000g கிராம் உட்பட்ட பச்சிளம் குழந்தைகளுக்கு தேங்காய் எண்ணெய், சூரியகாந்தி எண்ணெய் அல்லது எண்ணெய் இல்லாமல் மசாஜ் செய்வது குறித்து முறைப்படி தாய்மார்களுக்கு கற்றுக் கொடுத்து அதனுடைய விளைவுகளை நமது எழும்பூர் மகப்பேறு மருத்துவமனையின் பச்சிளம் குழந்தைகளுக்கான பிரிவில் ஆராயப்படும். குழந்தைகளுக்கு 3 மாதம் மசாஜ் செய்வதால், எடை, தலை சுற்றளவு, நீளம் ஆகியவை கூடுவதையும், மருத்துவமனைகளில் தங்கும் நாட்கள், கிருமிகளினால் பிரச்சனை, மீண்டும் மருத்துவமனையில் அனுமதி ஆகியவை ஆராயப்படும்.

இந்த ஆராய்ச்சியிலிருந்து எப்போதும் வேண்டுமானாலும் விலகிக் கொள்ளாலாம் என்பதை அறிவேன். என்னுடைய சுய விருப்பத்தின் பேரில் மட்டுமே இந்த ஆராய்ச்சியில் பங்கு கொள்கிறேன்.

பெயர் விவரங்கள் கட்டாயமாக பாதுகாக்கப்படும்.

தொலைபேசி எண்.

கையொப்பம்

INFORMATION SHEET

- We are conducting a Randomized Control study on massage in neonates 1000gms to 2000gms using Coconut oil Sunflower seed oil, or no oil in department of neonatology, Institute of obstetrics and gynecology, Madras medical college, Chennai.
- The purpose of this research is to study the effect of massage with Coconut oil Sunflower seed oil, or no oil for three months on weight gain, nosocomial infections, duration of hospital stay and readmissions.
- The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.
- Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled.
- The results of the special study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

Signature of investigator Signature of participant

Date:

S.No	Name	AGA/SGA	Oil	Rand. No.	D.O.B	IP No.	Sex	single/twins/triplet	amnion/chorion
1	B/o, Hemalatha Bakiyaraj	1	2	A1	21.04.12	8121	3	1	
2	B/o. Abitha Kutchalambal	1	2	A2	28.03.12	2423	3	1	
3	B/o Hemalatha Ratha	1	1	A3	04.04.12	8620	3	1	
4	B/o. Tamil Arasi	1	3	A4	21.03.12	7316	3	1	
5	B/o. Asha ***	1	3	A5	02.04.12	8472	3	1	
6	B/o Mahalakshmi 2	1	1	A6	24.03.12	7305	3	2	
7	B/o Mahalakshmi 1	1	1	A7	24.03.12	7305	3	1	
8	B/o Pushpa	1	3	A8	31.03.12	8464	4	1	
9	B/o. Lakshmi Mohan	1	2	A9	27.03.12	7800	3	1	
10	B/o Uma Maheshwari	1	2	A10	08.04.12	9031	3	1	
11	B/o Shalini	1	1	A11	08.04.12	9013	4	1	
12	B/o Rajalakshmi	1	3	A12	13.04.12	9451	3	1	
13	B/o. Nandhini	1	1	A13	07.04.12	27726	4	1	
14	B/o. Shanthi	1	1	A14	29.03.12	28856	3	1	
15	B/o. Mariya selvi	1	3	A15	29.3.12	9521	4	1	
16	B/o.Subulakshmi	1	2	A16	14.04.12	10125	4	1	
17	B/o. Mohana	1	3	A17	16.04.12	9835	3	1	
18	B/o. Lakshmi	1	2	A18	14.04.12	9610	3	1	
19	B/o. Dhivya	1	1	A19	14.04.13	9682	3	1	
20	B/o Maheshwari *	1	2	A20	13.04.12	9552	3	1	
21	B/O. Tamil selvi **	1	2	A21	10.04.12	9290	3	1	
22	B/o. Soundarya	1	3	A22	18.04.12	10062	4	1	
23	B/o. Sathya	1	3	A23	14.04.12	10065	3	1	
24	B/o. Girisha	1	1	A24	02.04.12	8366	3	1	
25	B/o. Kalaivani	1	1	A25	24.04.12	10545	3	1	
26	B/o. Latha 1	1	3	A26	22.04.12	10440	3	2	4
27	B/o. Latha II	1	2	A27	22.04.12	10441	3	2	4
28	B/o. Sargunam	1	2	A28	19.04.12	1597	3	1	
29	B/o. Sumathi	1	1	A29	29.04.12	10806	3	1	
30	B/o. Ambika	1	1	A30	28.04.12	10896	3	1	
31	B/o. Dili Rani	1	2	A31	08.05.12	1205	3	1	
32	B/o. Kalai arasi	1	1	A32	04.05.12	11441	4	1	
33	B/o. Amulu	1	3	A33	04.05.12	11413	3	1	
34	B/o. Chamundeshwari 1	1	2	A34	14.05.12	12595	3	2	4
35	B/o. Thulasi 1	1	3	A35	19.05.12	13123	3	2	4

S.No	D.O.A	D.O.D	Duration Hosp. Days	Mode of Delivery	Gravida	para	Sibling No.	B.Wt.(gms)	Gestage (wks)	LMP	EDD
1	21.04.12	31.04.12	10	1	1	0	0	1750	34	31.08.11	07.06.12
2	28.03.12	18.04.12	22	1	1	0	0	1200	32		17.05.12
3	04.04.12	09.04.12	5	1	2	0	1	1815	33	14.08.11	21.05.12
4	21.03.12	12.04.12	22	1	1	0	0	1400	30	25.08.11	01.06.12
5	02.04.12	17.04.12	15	1	1	0	0	1500	33	16.08.11	23.5.12
6	24.03.12	12.04.12	18	1	1	0	0	1545	33	23.08.11	30.05.12
7	24.03.12	12.04.12	18	1	1	0	0	1500	33	23.08.11	30.05.12
8	02.04.12	12.04.12	10	3	1	0	0	1700	32	14.08.11	21.05.12
9	27.03.12	09.04.12	13	1	1	0	0	1700	33	10.08.11	17.05.12
10	08.04.12	24.04.12	16	1	1	0	0	1525	33	18.08.11	25.05.12
11	08.04.12	24.04.12	16	1	1	0	0	1535	32		
12	13.04.12	16.04.12	3	1	1	0	0	1910	36	11.08.11	18.05.12
13	07.04.12	27.04.12	20	1	1	0	0	1170	30	5.9.11	12.6.12
14	29.03.12	17.04.12	19	3	5	2	0	2000	34	14.8.11	21.5.12
15	13.04.12	01.05.12	18	3	1	0	0	1350	30	10.9.11	17.6.12
16	14.04.12	23.04.12	4	1	1	0	0	1835	34	15.8.11	22.5.12
17	16.04.12	23.04.12	4	1	1	0	0	1870	31	8.9.11	15.6.12
18	14.04.12	23.04.12	9	4	1	0	0	1525	30	22.9.11	29.6.12
19	14.04.13	20.04.13	6	1	1	0	0	1740	33		
20	13.04.12	29.04.12	16	1	1	0	0	1500	33	28.08.11	05.06.12
21	10.04.12	21.05.12	41	1	1	0	0	1100	30		
22	18.04.12	23.04.12	6	1	1	0	0	2000	34		
23	14.04.12	05.05.12	21	1	1	0	0	1250	31	10.9.11	17.6.12
24	02.04.12	02.04.12	1	3	1	0	0	1220	29	3.9.11	10.6.12
25	24.04.12	05.05.12	11	1	1	0	0	1550	33	26.9.11	4.6.12
26	22.04.12	08.05.12	16	1	1	0	0	1435	32	5.9.11	4.6.12
27	22.04.12	08.05.12	16	1	1	0	0	1365	32	5.9.11	4.8.12
28	19.04.12	10.05.12	21	1	1	0	0	1445	32	31.8.11	7.6.12
29	12.5.12	13.05.12	2	1	1	0	0	1825	34	21.8.11	4.6.12
30	28.04.12	05.05.12	7	1	1	0	0	1800	31	19.9.11	26.6.12
31	08.05.12	18.05.12	11	3	3	1	0	1940	33		2.7.12
32	04.05.12	12.06.12	39	1	1	0	0	1096	30		5.7.11
33	04.05.12	25.05.12	21	3	1	0	0	1475	30	05.10.11	12.07.12
34	14.05.12	02.06.12	19	1	1	0	0	1560	32		
35	19.05.12	26.05.12	8	1	1	0	0	1950	33	25.9.11	2.7.12

S.No	Birth asphyxia	Diabetes	PIH	Eclampsia	Liquor	Oligohydr	Polyhydr	Hypothyr	Drugs	Inf.Dis	infertility	APLA	CHD	MSAF	PROM	PV >3	Pro labour	Placenta
1	2	2	2	2	8	2	2	2	2	2	2	2	2	2	1	2	2	1
2	1	2	1	2	8	2	2	2	2	2	2	2	2	2	1	1	2	1
3	2	2	2	2	8	2	2	2	2	2	2	2	2	2	1	2	2	1
4	2	2	2	2	8	2	2	2	2	2	2	2	2	2	1	2	2	1
5	2	2	2	2	8	2	2	2	2	2	2	2	2	2	1	2	2	1
6	2	2	2	2	8	2	2	2	2	2	1	2	2	2	1	2	2	1
7	2	2	2	2	8	2	2	2	2	2	1	2	2	2	1	2	2	1
8	2	1	2	2	8	1	2	2	2	2	2	2	2	2	1	2	2	1
9	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	1	1
10	2	2	2	2	8	1	2	2	2	2	2	2	2	2	2	2	2	1
11	2	2	2	2	8	2	2	2	2	2	2	2	2	2	1	2	2	1
12	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1
13	2	2	2	2	8	2	2	2	2	2	2	2	2	1	1	2	2	1
14	2	1	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1
15	2	2	2	2	8	2	2	2	2	2	2	2	2	2	1	2	2	1
16	2	2	2	2	8	2	2	2	2	2	2	2	2	2	1	2	2	1
17	2	2	1	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1
18	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1
19	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1
20	2	2	1	0	8	1	2	2	2	2	2	2	2	2	2	2	2	1
21	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1
22	2	2	2	2	8	2	2	2	2	2	2	2	2	2	1	2	2	1
23	2	2	2	2	8	2	2	2	2	2	2	2	2	2	1	2	2	1
24	2	2	2	2	8	1	2	2	2	2	2	2	2	2	1	2	2	1
25	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1
26	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1
27	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1
28	2	2	1	2	8	1	2	2	2	2	2	2	2	2	2	2	2	1
29	2	2	2	2	8	1	2	2	2	2	2	2	2	2	2	2	2	1
30	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1
31	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	3
32	1	2	1	2	8	2	2	2	2	1	2	2	2	2	2	2	2	1
33	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	3
34	2	2	2	2	8	2	2	2	2	2	2	2	2	2	1	2	2	1
35	2	2	2	2	8	2	2	2	2	2	2	2	2	2	2	2	2	1

S.No	Ant steroid	Doppler	CTG	CPAP	M vent	TTN	HMD	Surfactant	suspected sepsis	Clinical Sepsis	Culture + Sepsis	Organism	Photo therapy	Apnea	Feed Intolerence	Hypoglycemia
1	1	2	7	2	2	2	2		2	2	2		2	2	2	2
2	1	2	7	2	2	2	2		2	2	2		2	2	2	2
3	1	2	7	2	2	2	2		2	2	2		2	2	2	2
4	1	2	5	2	2	1	2		2	2	2		2	2	2	2
5	1	2	7	2	2	2	2		2	2	2		2	2	2	2
6	1	2	7	2	2	1	2		2	1	2		1	2	1	2
7	1	2	7	2	2	1	2		2	1	2		1	2	1	2
8	1	2	5	2	2	2	2		2	2	2		2	2	2	2
9	1	2	7	2	2	2	2		2	2	2		2	2	2	2
10	1	2	5	2	2	2	2		2	2	2		1	2	2	2
11	1	2	5	2	2	2	2		2	2	2		2	2	2	2
12	1	2	7	2	2	2	2		2	2	2		2	2	2	2
13	1	2	7	1	2	2	1		2	2	2		2	1	2	2
14	2	2	7	2	2	2	2		2	2	2		1	2	2	2
15	1	2	7	2	2	2	2		2	2	2		1	2	2	2
16	1	2	5	2	2	1	2		2	2	2		2	2	2	2
17	1	2	5	2	2	1	2		2	2	2		2	2	2	2
18	2	2	7	2	2	2	2		2	2	2		2	2	2	2
19	2	2	7	2	2	2	2		2	2	2		2	2	2	2
20	1	2	5	2	2	2	2		2	2	2		2	2	2	2
21	1	2	7	2	2	2	2		2	2	2		1	2	1	2
22	1	2	7	2	2	2	2		2	2	2		2	2	2	2
23	1	2	7	2	2	2	2		2	2	2		2	2	2	2
24	1	2	7	2	2	2	2		2	1	2		2	2	2	2
25	1	2	7	2	2	2	2		2	2	2		2	2	2	2
26	2	2	7	2	2	2	2		2	2	2		2	2	2	2
27	2	2	7	2	2	2	2		2	2	2		2	2	2	2
28	1	2	7	2	2	2	2		2	2	2		2	2	2	2
29	2	2	5	2	2	2	2		2	2	2		2	2	2	2
30	1	2	5	1	2	1	2		2	2	2		2	2	2	2
31	1	2	7	2	2	1	2		2	2	2		2	2	2	2
32	2	2	7	2	2	2	2		2	1	2		1	2	1	2
33	2	2	7	1	2	1	2		2	2	2		2	2	2	2
34	2	2	7	2	2	2	2		2	2	2		2	2	2	2
35	2	2	5	1	2	1	2		2	1	2		1	2	2	2

S.No	S.Arthritis	B.C Gestational Age	B.C Birth weight (gms)	B.C Enrollment day	B.C weight on enrollment	B.C Length (cm)	B.C HC (cm)	Re Admission	suspected sepsis	R A Sepsis	Organism	R A Bleeding ICH	R A Bleeding GI
1	2	34	1750	5	1650	41	28	10	2	10		10	10
2	2	32	1187	7	1187	39	28.2	10	2	2		2	2
3	2	33	1200	3	1723	43	30	10	2	2		2	2
4	2	30	1400	14	1260	40.5	28.1	10	2	10		10	10
5	2	33	1500	5	1429	41.5	29	1	2	2		2	2
6	2	33	1545	14	1208	39	28.5	10	2	10		10	10
7	2	33	1505	14	1232	40.5	28.5	10	10	10		10	10
8	2	32	1700	9	1518	42	28.5	2	2	2		2	2
9	2	33	1700	9	1576	43	29.3	2	2	2		2	2
10	2	33	1525	5	1338	42	28.6	10	10	10		10	10
11	2	32	1525	10	1287	42.5	28.8	2	2	2		2	2
12	2	36	1910	5	1630	42.5	30	10	2	10		10	10
13	2	30	1170	14	1151	41.5	27.5	2	2	2		2	2
14	2	34	2000	14	1749	47	28.6	2	2	2		2	2
15	2	30	1350	5	1302	40.5	27	2	2	2		2	2
16	2	34	1835	3	1626	43	30	10	10	10		10	10
17	2	31	1870	3	1635	42	29.5	10	10	10		10	10
18	2	30	1525	5	1402	40.5	28.8	10	10	10		10	10
19	2	33	1740	4	1544	42	29.8	10	10	10		10	10
20	2	33	1500	4	1463	42.05	27.5	2	2	2		2	2
21	2	30	1100	9	1082	39	26	2	2	2		2	2
22	2	34	2000	4	1816	42	30	10	10	10		10	10
23	2	31	1250	13	1200	39.5	26	2	2	2		2	2
24	2	29	1220	14	1034	40.5	27	2	2	2		2	2
25	2	33	1550	5	1320	41.5	28.5	2	2	2		2	2
26	2	32	1435	2	1316	41.5	28.5	2	2	2		2	2
27	2	32	1365	2	1268	385.5	27.8	2	2	2		2	2
28	2	32	1445	13	1440	39.5	28	2	2	2		2	2
29	2	34	1825	5	1621	42.5	32.5	2	2	2		2	2
30	2	31	1800	7	1675	44.5	29.4	2	2	2		2	2
31	2	33	1940	6	1655	43.5	29.5	2	2	2		2	2
32	2	30	1096	13	1226	37.5	25.6	1	2	2		2	2
33	2	30	1475	13	1226	39	27.7	2	2	2		2	2
34	2	32	1560	5	1369	42	28.6	2	2	2		2	2
35	2	33	1950	5	1714	40	31	2	2	2		2	2

S.No	late HDN	R A Bronchiolitis	R A Pneumonia	R A Inghernia	R A Abscess	viral fever	apnea	R A Jaundice	Mortality	No. of days alive	M Bleed ICH	M Bleed GI	M Sepsis	M Postop	M SIDS	M Aspiration
1	2	2	10	10	10	2	2	10	10		10	10	10	10	10	10
2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
3	2	2	2	2	2	2	2	2								
4	2	2	10	10	10	2	2	10	10		10	10	10	10	10	10
5	1	2	2	2	2	2	2	2	1	74	1	2	2	2	2	2
6	2	2	10	10	10	2	2	10	10		10	10	10	10	10	10
7	2	2	10	10	10	2	2	10	10		10	10	10	10	10	10
8	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
9	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
10	2	2	10	10	10	2	2	10	10		10	10	10	10	10	10
11	2	2	2	2	2	2	2	2	1		2	2	2	2	2	2
12	2	2	10	10	10	2	2	10	10		10	10	10	10	10	10
13	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
14	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
15	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
16	10	10	10	10	10	2	10	10	3		3	3	3	3	3	3
17	10	10	10	10	10	2	10	10	3		3	3	3	3	3	3
18	10	10	10	10	10	2	10	10	3		3	3	3	3	3	3
19	10	10	10	10	10	2	10	10	3		3	3	3	3	3	3
20	2	2	2	2	2	2	2	2	1	26	2	2	2	2	2	2
21	2	2	2	2	2	2	2	2	1	67	2	2	2	2	2	1
22	10	10	10	10	10	10	10	10	3		3	3	3	3	3	3
23	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
24	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
25	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
26	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
27	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
28	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
29	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
30	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
31	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
32	2	2	1	2	2	2	2	2	2		2	2	2	2	2	2
33	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
34	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2
35	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2

S.No	Seizures	Pneumonia	Followup days	Day	Weight (gms)	Length (cm)	HC (cm0	Day	Weight (gms)	Length (cm)	HC (cm0	Day	Weight (gms)	Length (cm)	HC (cm0	Day	Weight (gms)
1	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	14	1	1187	39	28.2	2	1198	0	0	3	1225	0	0	5	1246
3		2	5	1	1723	43	30	2	1686	0	0	3	1698	0	0	4	1676
4	10	2	7	1	1260	40.5	28.1	2	1265	0	0	3	1265	0	0	4	1279
5	2	2	74	1	1429	41.5	29	11	1461	42	29.8	14	1510	43	30.2	35	1705
6	10	2	50	1	1208	39	28.5	2	1219	0	0	5	1222			10	1300
7	10	2	50	1	1232	40.5	28.5	2	1257	0	0	5	1282			10	1402
8	2	2	90	1	1518	42	28.5	5	1558	42	28.5	33	2.239	47.5	31.5	40	2.416
9	2	2	96	1	1576	43	28.3	12	1604			45	2492	49	34.3	55	2796
10	10	2	11	1	1338	42	28.6	11	1451	42	29.5	0	0	0	0	0	0
11	2	2	36	1	1287	42.5	28.8	7	1391	42.5	29.8	36	1694	44	30.5	0	0
12	10	2	3	1	1630	42.5	30	3	1708	42.5	30	0	0	0	0	0	0
13	2	2	90	1	1151	41.5	27.5	57	1683	44	31.5	90	2491	47.6	33.2	90	0
14	2	2	105	1	1749	47	28.6	45	1832	47	32.8	51	1957	47	32.8	73	2210
15	2	2	95	1	1302	40.5	27	25	1269	41.5	28.5	34	1563	43.5	29.4	45	1783
16	3	3	0	1	1626	43	30	0	0	0	0	0	0	0	0	0	0
17	3	3	0	1	1635	42	29.5	0	0	0	0	0	0	0	0	0	0
18	3	3	5	1	1402	40.5	28.8	5	1445	41	29.3	0	0	0	0	0	0
19	3	3	3	1	1544	42	29.8	3	1547	0	0	0	0	0	0	0	0
20	1	2	26	1	1463	42.05	27.5	4	1457	0	0	0	0	0	0	0	0
21	2	2	60	1	1082	39	26	26	1130	39	27.2	60	1609	42	30.2	0	0
22	3	3	0	1	1816	42	30	0	0	0	0	0	0	0	0	0	0
23	3	3	97	1	1200	39.5	26	15	1352	39.5	28	22	1438	42	30.8	32	1571
24	2	2	10	1	1034	40.5	27	10	1215	42	27.5	0	0	0	0	0	0
25	2	2	92	1	1320	41.5	28.5	12	1515	42	29.6	22	1683	42	30.5	41	2390
26	2	2	90	1	1316	41.5	28.5	13	1453	43	29	17	1540	43	29.6	25	1764
27	2	2	90	1	1268	38.5	27.8	13	1470	42.5	28.5	17	2543	42.5	29.5	25	1797
28	2	2	91	1	1440	39.5	28	8	1359	40	28.5	22	1415	43	29	54	1969
29	2	2	95	1	1621	42.5	32.5	16	2138	45	33	40	3342	50	35.6	70	4425
30	2	2	98	1	1675	44.5	29.4	14	1629	45	30.2	22	1680	45	30.5	35	2110
31	2	2	93	1	1655	43.5	29.5	5	1735	44.5	29.6	20	2206	47.5	31.6	47	3140
32	2	2	84	1	1226	37.5	25.6	12	1063	38.5	26.2	26	1131	38.5	26.4	29	1170
33	2	2	92	1	1226	39	27.7	8	1328	40.5	28.2	15	1373	41.5	29	24	1433
34	2	2	100	1	1369	42	28.6	10	1392	42	29	15	1565	42.5	30.2	21	1835
35	2	2	93	1	1714	40	31	7	1578	42	31	11	1527	42	31	36	1802

S.No	Length (cm)	HC (cm)	Day	Weight (gms)	Length (cm)	HC (cm0	Day	Weight (gms)	Length (cm)	HC (cm)	Day	Weight (gms)	Length (cm)	HC (cm)	Day	Weight (gms)	Length (cm)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	6	1252	0	0	7	1271			8	1301			9	1330	
3	0	0	5	1692	43	30	0	0	0	0	0	0	0	0	0	0	0
4	0	0	5	1317	0	0	6	1344				1344	0	0	0	0	0
5	43.5	31.5	47	1931	45	32.5	60	2242	45	38.2	74	2551	47	35	0	0	0
6	40.5	29	12	1337	0	0	17	1392	0	0	40	1368	42	32	0	0	0
7	40.5	29	12	1471	0	0	17	1443	0	0	40	1484	42.5	32	0	0	0
8	47.5	32.5	61	3.069	53	33.2	90	3.909	57	36	0	0	0	0	0	0	0
9	49.5	35.6	78	3291	82	37	96	3746	56	37.2	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	49	35.5	91	2818	53.8	366	0	0	0	0	0	0	0	0	0	0	0
15	46.5	31.8	67	1927	46.5	32	95	3049	49.8	35.8	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	42	31	61	1867	42	31.5	85	2740	473	34.3	97	3067	47.8	36.2	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	46.5	3.3	63	3076	50.5	34.5	92	3940	52.8	37.6		0	0	0	0	0	0
26	44	30	33	234	46.5	31.2	90	3598	51.6	34.5	0	0	0	0	0	0	0
27	43.5	30.5	33	2185	46.5	31.5	90	3401	52.8	34.3	0	0	0	0	0	0	0
28	45	30.6	91	3097	50.5	33.4	0	0	0	0	0	0	0	0	0	0	0
29	56.5	37.5	95	5030	57	38.5	0	0	0	0	0	0	0	0	0	0	0
30	47	32.6	45	2552	48.5	33.5	70	2948	51.5	35.2	91	3394	53	36	0	0	0
31	51.5	34.2	93	4616	52.5	36.8	0	0	0	0	0	0	0	0	0	0	0
32	40.5	26.8	50	1335	40.5	29.2	84	2.5	41	30	0	0	0	0	0	0	0
33	41.5	29	37	1588	41	30.2	37	1588	41	31.2	81	1764	44.6	32.8	92	1872	44.6
34	44	31.2	26	1890	45	31.4	33	2247	47.2	3.3	64	3169	50.6	34	87	3747	53.5
35	43.2	33.8	58	2498	46.8	14.8	93	3647	53	38.2	0	0	0	0	0	0	0

S.No	HC (cm)	Day	Weight (gms)	Length (cm)	HC (cm)	Day	Weight (gms)	Length (cm)	HC (cm)	Day	Weight (gms)	Length (cm)	HC (cm)	mean w t gain(gms)/day 1st month	mean w t gain(gms)/day 2 nd month	mean w t gain(gms)/day 3rd month
1	0	0	0	0	0	0	0	0	0	0	0	0	0			
2		10	1370			13	1420			14	1475	41.5	29.7	20.57		
3	0	0	0	0	0	0	0	0	0	0	0	0	0			
4	0	0	0	0	0	0	0	0	0	0	0	0	0			
5	0	0	0	0	0	0	0	0	0	0	0	0	0	7.88	21.48	22.07
6	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	
7	0	0	0	0	0	0	0	0	0	0	0	0	0	6.3	6.3	
8	0	0	0	0	0	0	0	0	0	0	0	0	0	21.84	29.64	28.96
9	0	0	0	0	0	0	0	0	0	0	0	0	0	22.57	30.4	23.17
10	0	0	0	0	0	0	0	0	0	0	0	0	0	10.27		
11	0	0	0	0	0	0	0	0	0	0	0	0	0	11.03		
12	0	0	0	0	0	0	0	0	0	0	0	0	0			
13	0	0	0	0	0	0	0	0	0	0	0	0	0	9.33	24.48	24.48
14	0	0	0	0	0	0	0	0	0	0	0	0	0	2.7	12.04	15.9
15	0	0	0	0	0	0	0	0	0	0	0	0	0	7.6	11.03	40.07
16	0	0	0	0	0	0	0	0	0	0	0	0	0			
17	0	0	0	0	0	0	0	0	0	0	0	0	0			
18	0	0	0	0	0	0	0	0	0	0	0	0	0	10.6		
19	0	0	0	0	0	0	0	0	0	0	0	0	0			
20	0	0	0	0	0	0	0	0	0	0	0	0	0			
21	0	0	0	0	0	0	0	0	0	0	0	0	0	3.18	15.14	
22	0	0	0	0	0	0	0	0	0	0	0	0	0			
23	0	0	0	0	0	0	0	0	0	0	0	0	0	11.5	19.7	24
24	0	0	0	0	0	0	0	0	0	0	0	0	0	18.1		
25	0	0	0	0	0	0	0	0	0	0	0	0	0	16.5	33.97	29.7
26	0	0	0	0	0	0	0	0	0	0	0	0	0	21.75	27.4	27.4
27	0	0	0	0	0	0	0	0	0	0	0	0	0	27.78	21.3	21.3
28	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	14.18	30.48
29	0	0	0	0	0	0	0	0	0	0	0	0	0	43.02	36.1	24.2
30	0	0	0	0	0	0	0	0	0	0	0	0	0	15.5	19.95	21.23
31	0	0	0	0	0	0	0	0	0	0	0	0	0	27.55	34.5	32.08
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21.11	7.85
33	33.3	0	0	0	0	0	0	0	0	0	0	0	0	9.78	5.16	5.16
34	37	95	4110	54.5	37.1	100	4384	54.5	37.3	0	0	0	0	26.6	29.74	30.35
35	0	0	0	0	0	0	0	0	0	0	0	0	0	2.44	31.63	32.82

S.No	mean w t gain(gms)/day overall	mean Length gain(cm)/wk 1st month	mean Length gain(cm)/wk 2nd month	mean Length gain(cm)/wk 3rd month	mean Length gain(cm)/wk over all	Mean HC gain (cm)/wk 1st month	Mean HC gain (cm)/w k 2nd month	Mean HC gain (cm)/wk 3rd month	Mean HC gain (cm)/wk overall	%wt gaini 1st month	%wtgain 2nd month	%wt gain 3rd month	% wt gain overall
1													
2		1.25				0.75							
3													
4													
5	15.06	0.4	0.42	1	0.61	0.3	0.47	0.9	0.56				
6		0.52	0.52			0.61	0.61						
7		0.27	0.27			0.63	0.63						
8	26.56	1.17	1.37	1.1	1.16	0.63	0.42	0.68	0.58				
9	22.6	0.93	0.35	1.1	0.94	0.78	0.92	0.27	0.57				
10		0.32				0.58							
11		0.49				0.33							
12													
13	14.8	0.3	0.76	0.76	0.47	0.45	0.45	0.45	0.42				
14	10.18	0	0	0.88	0.52	0.98	0	0.49	0.61				
15	18.38	0.62	0.63	0.82	0.68	0.5	0.55	0.95	0.65				
16													
17													
18		0.714				0.714							
19													
20													
21	8.78	0.2	0.5		0.35	0.33	0.32		0.49				
22													
23	19.2	0.54	0.54	0.812	0.59	1.09	0.23	0.65	0.736				
24		0.71				0.35							
25	28.47	0.15	1.45	0.5	0.86	0.63	0.68	0.74	0.69				
26	25.35	1.06	0.6	0.6	0.78	0.57	0.4	0.4	0.46				
27	23.7	1.7	0.7	0.7	1.11	0.78	0.34	0.34	0.5				
28	18.2	1.11	0.43	1.04	0.84	0.82	0.35	0.53	0.41				
29	35.88	1.315	1.51	0.28	1.11	0.89	0.21	0.28	0.59				
30	18.8	0.625	0.75	0.5	0.653	0.8	0.43	0.26	0.5				
31	31.83	1.4	1.03	0.91	0.6	0.73	0.67	0.395	1.11				
32	15.16	0.72	0	0.3	0.41	0.28	0.8	0.26	0.4				
33	7.02	0.38	0.46	0.46	0.42	0.48	0.39	0.39	0.42				
34	28.85	1.1	0.76	0.88	0.925	0.93	0.22	0.701	0.62				
35	20.78	0.62	1.146	1.24	0.98	0.54	0.318	0.68	0.54				

	Code
Yes	1
No.	2
Male	3
Female	4
Gravida para	
Primi	1
CTG	
Reactive	5
Non reactive	6
Not done	7
Doppler	
Abnormal	1
not done	2
Liquor	
clear	8
meconium	9
Readmission	
yes	1
no	2
not known	10
Normal	1
Elective LSCS	2
Emergency LSCS	3
Forceps	4
Vacuum	5
Oil	
CCO	1
SSO	2
NO	3

Death	
yes	1
No	2
Not known	3

single	1
twins	2
triplet	3

Organisum	
Klebsiella	1
E.coli	2
staph aureus	3
enterobacter	4
Placenta	1
Healthy	2
Abruptio	3
Praevia	

Followup colour code

	Completed
	< 2 weeks
	0
	1 month
	2 months
	3 month
	Death

0 followup	#
1 month	*
2 months	**
3 month	***

chorion/amnion	
mcma	1
mcda	2
dcma	3
dcda	4